IMMIGRATION, LABOUR FORCE, AND THE AGE STRUCTURE OF THE POPULATION

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ABSTRACT

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The paper explores the effects of immigration on the rates of growth of the population and labour force and on the age distribution and dependency relations within the population. Projections are presented and the consequences of different future rates of immigration are investigated. Dependency ratios based on various definitions are proposed and calculated, and the effects on the ratios of alternative future immigration rates are evaluated. The regional implications of different immigration rates are evaluated also. Simulations are carried out to determine how much immigration would be required to stabilize the future rate of growth of the labour force.

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IMMIGRATION, LABOUR FORCE, AND THE AGE STRUCTURE OF THE POPULATION*

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1. INTRODUCTION

We explore, in this paper, the effects of immigration on the rates of growth of the population and labour force and on the changing age distribution and dependency relations within the population. We look back forty-five years to review the history and consequences of immigration since the 1950s, in that context, and then forward forty-five to try to understand how it might affect the future course of demographic change. The population is aging, in a collective sense: the total fertility rate has been below the natural replacement level since the early 1970s, life expectancies have continued to rise, and the postwar baby boom generation is moving through middle age, and in less than twenty years will start to cross the retirement threshold. Population and labour force growth rates are on long-run downward paths and the proportion of older people is projected to increase sharply as we move through the decades of the next century. What is the role of immigration in that scenario, and to what extent could the scenario be affected by higher or lower rates of immigration? How would different rates affect the future age distribution of the population and the associated "dependency burden"? How much immigration would be required to prevent the rate of growth of the labour force from falling?

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We address those questions and others. First, though, the historical background.

2. HISTORICAL BACKGROUND

Annual numbers of landed immigrants -- gross immigration, as we shall say, or simply immigration, when the intended meaning is clear -- are plotted for years since 1951 in Figure 1 in thousands, and in Figure 2 as percentages of the population. The most striking feature of the figures is the variability of the time series. The numbers of immigrants range from 72 thousand in 1961 to 282 thousand in 1957; as percentages of the population they range from 0.32 in 1985 to 1.66 in 1957. There is obvious serial correlation in the series but clearly immigration has been a highly volatile element in the annual growth of the population since the 1950s. (The same could be said of the whole of the 20th century, and much further back in Canadian history, for that matter; see Denton, 1970, for tabulations and discussion relating to periods back as far as the middle of the 19th century.)

Migration is not, of course, all in one direction, and net immigration has typically been a good deal smaller than gross immigration, although it can in fact be greater (as it was in the latter half of the 1980s), by virtue of the way it is defined. We define it here as the difference between total population increase and natural increase (births minus deaths). Equivalently, it can be defined as gross immigration, plus Canadians returning from abroad, minus emigration, plus the net increase in nonpermanent residents, plus an adjustment to reflect any discrepancy between the 5-year sum of the measured components of population change and the 5-year difference in population size based on consecutive censuses. (The excess of net over gross immigration in the latter half of the 1980s was the result of a large increase in the number of nonpermanent residents.) Comparisons of net and gross immigration are provided in Table 1 for 5-year

intervals, beginning with 1951-56. Also provided are population totals and increases, the natural components of the increases, and the percentage shares attributable to natural increase and net immigration. As the table shows, net immigration has accounted for a variable but substantial share of population growth since the early 1950s. Since the mid-1980s it has accounted for almost half of the total growth, thus offsetting, in large measure, the effects of continuing low fertility rates.

Immigrants, when they enter Canada, are younger, on average, than the population as a whole, and somewhat more concentrated in the working ages. Table 2 compares the percentage distributions of immigrants between men and women, and among broad age groups, in the decades 1976-86 and 1986-96, with the corresponding distributions of the population in the 1981 and 1991 censuses (those years being the midpoints of the immigration decades.) In the most recent decade, about 66 percent of all immigrants were in the working-age range, taking 20-64 as a rough approximation to that range, compared with 61 percent for the population; 54 percent were in the younger half of the range, 20-44, compared with 42 percent for the population. Only about 4 percent of all immigrants were 65 and older, compared with 11 percent for the population. Both immigrants and the population were divided about equally between men and women.

The impact of immigration on the population growth rate has varied greatly since the 1950s, and so has its impact on the labour force growth rate. Indeed, the variation is even more pronounced in the latter case. That is evident in Table 3. The share of labour force growth accounted for by net immigration, as estimated for 5-year periods in the last column of the table, was as low as 10 percent in 1976-81, when baby boomers were entering the work force in large numbers. In the early years of the 1950s, on the other hand, net immigration accounted for more

than half of the increase, and thus helped to make possible the very rapid economic expansion of that period. However, the most striking of the share calculations in Table 3 is the very high proportion in the 1990s: from 1991 to 1996, an estimated 71 percent of all labour force growth was attributable to net immigration.

In sum, then, immigration has been an important but highly variable element in the postwar growth of the population and labour force, and a dominant source of labour force growth in the 1990s. We shall consider where the population is headed, and the possible role of immigration in the Canadian demographic future. Before doing so, though, we digress briefly to examine the relationship between immigration policy and unemployment, and thereby try to throw some light on the high degree of variability evident in the annual series plotted in Figures 1 and 2.

3. IMMIGRATION POLICY AND THE RATE OF UNEMPLOYMENT

Recent and detailed econometric studies of immigration and the state of the labour market include Alan Green and David Green (1995) and Marr and Siklos (1995). (See also the references to earlier studies in those papers.) Our contribution is much more modest. We posit a simple model of the relationship between total annual immigration and the overall rate of unemployment. Implicit in that relationship is a rough summary characterization of the de facto postwar policy of the Canadian government, which may or may not be the same as its announced policy at different times over the period. (See Alan Green and David Green, 1996, for a review and discussion of official immigration policy.) Our model is based on the following assumptions:

Assumption 1: Immigration is demand-constrained. That is to say, the world supply of potential immigrants exceeds the number that the government is willing to admit, at all times. The annual

rate of flow of immigrants is thus determined by government policy. The assumption might be quite inappropriate for immigration from particular countries or regions of the world but it seems appropriate for the world as a whole.

Assumption 2: Government policy (implicit or explicit) with respect to total annual immigration has been largely of a short-run nature and determined by the state of the labour market, as reflected in the difference between the aggregate unemployment rate and what may be termed the "politically acceptable" rate. (The "politically acceptable" rate need not be the same as the "natural" rate of unemployment, although the two may have some kinship.)

Assumption 3: The "politically acceptable" unemployment rate has risen over the decades since the 1950s (along with average actual rates and estimates of the "natural" rate; the actual rate averaged less than 4 percent in the 1950s, 5 percent in the 1960s, almost 7 percent in the 1970s, more than 9 percent in the l980s, and roughly 10 percent in the first seven years of the 1990s).

Assumption 4: Immigration policy is subject to inertia and delays in the adjustment to changes in the unemployment rate.

Assumption 5: Immigration encourages further immigration. Growth of the population of postwar immigrants in Canada has had the long-run cumulative effect of increasing social and political acceptance of higher levels of annual immigration.

The model itself is of the form

$$(1)\quad I_t = \beta_0 + \beta_1(u-\bar{u})_{t-1} + \beta_2 S_{t-1} + \beta_3 I_{t-1} + \varepsilon_t$$

where I is gross immigration, u is the overall unemployment rate, $\bar{u}$ is the "politically acceptable" rate, S is the cumulative total of immigrants since 1951, ε is an error term, and the subscript t stands for year. (I may affect u by increasing the number of job seekers in the

labour market. From an econometric point of view, equation (1) is identified, and distinguished from the I → u relationship, by virtue of the lags and the absence of other variables that would have to be included in an unemployment determination equation.)

The model was estimated using the 35 annual observations in the period 1962 to 1996, with $\bar{u}$ in year t represented by the average actual unemployment rate over the preceding ten years (the period $t-1,\ldots,t-10$). The model fits the data well and easily satisfies standard statistical criteria. The estimated form of equation (1) is presented in Appendix A, along with the details of the estimation. (Consistent with the assumptions underlying the model, the estimate of β_1 is negative and the estimates of β_2 and β_3 are positive.)

Taking the model at face value, the estimate of β_1 implies that (on average, over the data period) an increase of 2 percentage points in the difference between the unemployment rate and the "politically acceptable" rate would have resulted in a decrease of some 25 thousand immigrants in the following year. If the higher gap had persisted, there would have been a subsequent further decline, and the direct effect on annual immigration would have approached 59 thousand over a period of years (calculated as $\beta_1/(1-\beta_3)$ times the 2 percent increase in the gap, with the indirect effect through S suppressed for the purpose of the calculation).

A full simulation with the model over the period 1962-96 generated a time path generally similar to the actual one, with annual immigration varying between 67 thousand and 243 thousand, a range of 176 thousand. That compares with a range of 181 thousand for the actual immigration series. The simulation was nonstochastic and "dynamic": accepting $u-\bar{u}$ as exogenous input and using actual 1961 observations as initial lagged values, the model generated

its own subsequent lagged values of I and S, year by year. An extended model would allow for contemporaneous, or possibly delayed, feedback from I to $\mathbf{u}$; treating $\mathbf{u} - \bar{\mathbf{u}}$ as exogenous in the simulation implies that other exogenous influences on the unemployment rate dominate, and that the I $\rightarrow \mathbf{u}$ effect can be ignored. As a matter of simple arithmetic, that seems reasonable in the present context. Although the model assumes that the government responds to the unemployment rate as a labour market signal, even a large change in the level of immigration would have little effect on the rate. Assume a reduction of 100 thousand in annual immigration and that half of all immigrants enter the labour force. (That is about the proportion in recent years, and a long-term average.) Assume a Canadian labour force of 15 million and an unemployment rate of 10 percent (roughly the average labour force and unemployment rate in 1996). Assume further that the unemployment rate for new immigrants is three times greater than the average (an assumption chosen simply for the purpose of the example). The 100 thousand reduction of immigration would then cause the overall unemployment rate to fall from 10 percent to 9.93 percent (all else equal), a drop of only seven one-hundreths of a percentage point. Even if the rate of unemployment among new immigrants were 100 percent the overall rate would fall by only three-tenths of a percentage point.

If one accepts our simple model and the calculations based on it we have some rough statistical confirmation of the past use of immigration as an instrument for influencing the labour market, at an aggregate level, and some guidance in explaining the high degree of variability of annual immigration in the past several decades. We shall consider later the possible future use of immigration as an instrument for controlling the rate of labour force growth.

4. THE LONG-TERM OUTLOOK: A BASELINE PROJECTION

We offer now, in Table 4, some projections of the population and labour force from 1996 to 2041, together with corresponding historical series back to 1951. We shall refer to the projections in the table as baseline projections, inasmuch as they will provide a standard of comparison for later ones in which we shall allow immigration to vary, up or down, in order to see the effects. The baseline projections assume annual gross immigration of 200,000 (just a little below its most recent level), distributed by age and sex in the same way as in the five-year period 1989-94 (very close to the 1986-96 distribution in Table 2), a total fertility rate of 1.64 children per woman (1995 value, the latest observed), a continuation of the downward trend in mortality rates (but at a decelerating pace), emigration and other components of net immigration consistent with recent patterns, and labour force participation rates that reflect some continuation of recent trends, by age and sex, but remain constant after 15 years into the projection period.[1] The projections were made using the demographic model incorporated into MEDS (an acronym for Models of the Economic-Demographic System; see Denton, Feaver, and Spencer, 1994). The MEDS demographic model and associated software operate with full single-year age detail, move the population of each sex forward one year at a time, and are capable of generating a large number of output tables. The projections in Table 4 are reported in summary form, at 5-year intervals.

In the broadest terms, the projected population growth rates represent a continuation of a trend that has been evident since the 1950s. From a peak 5-year growth rate of 14.8 percent in 1951-56, the rate fell continuously until the mid-1980s, rose somewhat in the latter part of that decade (with large numbers of nonpermanent residents entering the country), and then fell again

in the first part of the 1990s. The decline is projected to continue. From 6.1 percent in 1991-96, the 5-year growth rate is projected to fall to 3.8 percent within two decades, and to 1.1 percent by the end of the projection period. Thus, in spite of gross immigration of 200,000 per year, the maintenance of fertility rates below the natural replacement level would drive the population to near-zero growth by the fourth decade of the next century, under the assumptions of the baseline projections.

The effects of the baby boom, and the subsequent bust, are clearly in evidence in the changing age distribution of the population. In 1966, about 42 percent -- more than two-fifths -- of all people living in Canada were under 20 years of age. By 1996 the proportion had fallen to 27 percent, and by 2041 it is projected to be only about 20 percent. Concomitantly, the number of people 65 years of age and over rose from around 8 percent of the population in the 1950s and 1960s to 12 percent in 1996, and the projections call for continuous further increases, until by 2041 the proportion will exceed 25 percent, a little more than twice what it is today. (The age group 65 and over has long been the conventional statistical definition of "old," and we use it here. See Denton and Spencer, forthcoming, on the revision of the definition in light of changes in life table probabilities.) Reflecting the shifts in distribution, the median age of the population rose from 25 in 1966 to 35 in 1996; it is anticipated that it will rise by another ten years over the projection period.

Labour force growth rates have been influenced by the pronounced changes in patterns of participation since the 1950s -- by the increases in participation rates for women and the declines in the rates for older men, especially. They have been influenced also by the varying levels of immigration, as we have seen. Nevertheless, in broad terms the pattern of falling growth rates

resembles the population growth rate pattern, with a difference in timing of about two decades. The population growth rate was at its highest level in 1951-56, the labour force growth rate in 1971-76. The labour force growth rate then fell in every 5-year period down to 1991-96. A modest rise is projected for 1996 to 2001, followed again by consecutive declines. After 2011, the projected rates are effectively zero (a little above in some periods, a little below in others).

Under the assumptions on which the baseline projections rest, then, the rate of population growth will decline, the rate of labour force growth will decline even more rapidly, and the proportion of old people will rise -- will more than double over the projection period. A question of interest is what the declining rate of labour force growth and the shift in age distribution imply for the "dependency ratio" or "burden" in the decades ahead, and then how that ratio might be affected by changes in the level of immigration. We address those questions. Before doing that, though, we have to decide what we mean by "dependency ratio," and how the ratio should be interpreted.

5. DEFINING THE "DEPENDENCY RATIO"

The "dependency ratio" has long been used as a summary measure in demography. Shryock and Siegel (1975) provide two conventional definitions: they define the age dependency ratio as the ratio of the combined population 0-14 years of age and 65 and over to the population 15-64, and the economic dependency ratio as the ratio of the population not in the labour force to the labour force. The idea, of course, is that some part of the population is "inactive" or "dependent," while the other part is "active," or at least in the "active" age range, and the ratio of one to the other summarizes the relationship. Symbolically, the ratio is given by $d = D/A$. An alternative is to define D so as to include the "active" as well as the "inactive" parts, and we

prefer that. The idea then is that the A people must support themselves as well as the "inactive" members of the population; they too are dependents, being dependent on themselves.

The notion of a dependency ratio (however defined) implies a sort of pay-as-you-go economy. Within any given year, those in the population who are the producers of wealth support those who are not. Absent is any concept of saving and capital accumulation, so that people who are "active" in one period of their lives might provide support for themselves in a later period, when they are old. Nor is there any allowance for productivity differences, so that the ability to provide economic support might increase through time, or might vary from country to country or region to region, even if the dependency ratio were the same. The dependency ratio idea does not fit neatly into an economist's way of thinking. Nevertheless, it is a useful measure for summarizing some implications of an age distribution. Moreover, it would seem to be implicit in much of popular discussion of "population aging" -- of the future ability of the economy to support a large and increasing proportion of old people.

We propose, for discussion and calculation, five dependency ratio definitions. Let $\mathbf{P}$ be the total population, $\mathbf{P_w}$ the population of working age, $\mathbf{L}$ the labour force, $\mathbf{E}$ the number of persons employed, and $\mathbf{P^*}$ the population weighted to allow for age differences in per capita consumption or resource use. The five definitions are then as follows:

Unweighted P - based: Set $\mathbf{d = P/P_w}$. It is somewhat of a toss-up in Canada whether to define $\mathbf{P_w}$ as ages 15 to 64 or 20 to 64. We choose the latter, but in practice it makes hardly any difference for the calculations we present in the next section, which are in the form of indexes. (Eighteen to sixty-four might be the best definition -- as in Ahlburg and Vaupel, 1993, for

example -- but it is convenient to work with combinations of 5-year age groups.)

Unweighted P/L - based: Set $d = P/L$, the ratio of total population to labour force.

Unweighted P/E - based: Replace L with E, and write d = P/E. The "active" population is now defined as persons employed, rather than the labour force, which includes the unemployed.

Weighted P/L - based: The raw population count in the numerator is replaced with a weighted population measure, as described below. Using labour force as the denominator, the ratio becomes $d = P^*/L$.

Weighted P/E - based: The same as the previous one, except that E replaces L, and hence $d = P^*/E$.

P^* is intended to reflect the fact that the elderly, people of working-age, and young dependents may differ in their relative per capita "support costs," whereas P, the unweighted population measure, simply lumps all three groups together. (Failure to allow for differences is a criticism that has sometimes been made of conventional dependency ratio calculations. See Ahlburg and Vaupel, 1993, for discussion and review of literature on the use of weights.) We have used national expenditure data for 1991, by category, including both personal expenditure and government expenditure on goods and services, combined with relative per capita consumption weights for the broad age groups 0-19, 20-64, and 65 and over, to derive the weighted dependency ratios. Also, we have allowed some of the expenditure categories to be partly insensitive to population change. The national expenditure data, by category, in a form suitable for our purpose, are conveniently available in an interesting paper by Ruggeri and Hermanutz (1996). The age-group per capita weights are based on related data in some cases, our own estimates from previous studies in some, and just plain judgements (by us) in a number of other cases.

Although some of the choices of weights are arbitrary, we are comforted by the fact that the overall dependency ratio results are quite insensitive to the choices. Details of the calculations are provided in Appendix B. It is possible to write down a general formula that encompasses all of the above dependency ratio definitions, and others. That too is provided in Appendix B.

So much for definitions. Let us see how the results differ when values are calculated, based on the above five, and what the results tell us about past and future "dependency burdens."

6. CANADIAN DEPENDENCY RATIOS, PAST AND FUTURE

Historical dependency ratio series of the five types are shown in Table 5, at 5-year intervals from 1951 to 1996, followed by projected values up to 2041. The ratios are presented in index form, with base 100.0 in 1996, in order to focus on the changes through time. (Actual ratios are shown also for 1996.) The baseline population and labour force projections were used in the calculation of future ratios, supplemented by MEDS-based employment projections. For the latter, the overall unemployment rate was allowed to move from an annual average of 9.7 percent in 1996 to 9.0 in the year 2000, and was held constant thereafter. The age-group rates for men and women were adjusted so as to be consistent with the overall rate, based on historical relationships.

There is general similarity in the movements of all five indexes. All attain their highest levels during the baby boom period, and then decline. Four of the five have started to decline by 1966, and all five are on the way down by 1971. During the period 1986-96 they are close to constant, and that is true also for the projections through the first decade of the next century. The indexes then start to rise, as the population ages further, and the proportion of people 65 and over continues to increase. By 2026 they are some 6 to 10 percent above their 1996 level,

depending on which index one looks at, and by 2041 they are 11 to 16 percent above the 1996 level.

What is perhaps most interesting about the five dependency rate indexes is that at no time during the projection period do they come close to the levels they attained during the baby boom of the 1950s and early 1960s. That is true of the unweighted indexes, where children and the elderly are treated equally in the calculations. But it is true also of the other indexes, in the calculation of which we went to considerable trouble to introduce differential age-group weighting. Although the population is aging, and the proportion 65 and over is projected to more than double between 1996 and 2041, the dependency ratio, however defined, will still not approach the levels of the baby boom era. (In another study, Denton and Spencer, 1997, we calculated that the 65-and-over population would have to be weighted three times as heavily as the under-20 population in order for the projected dependency ratio to reach the baby boom levels; a three-fold difference seems quite unrealistic, based on our calculations.)

The foregoing serves to put the aging trend into some perspective: the country survived when two-fifths of the population were under 20; perhaps it can survive in the long-term future when one-quarter of the population may be 65 or older. The baby boom came upon the nation very quickly, in the space of just a few years, and took it (and demographers) by surprise. In contrast, population aging is a gradual process, and one that can be anticipated decades in advance.

7. THE EFFECTS OF ALTERING THE IMMIGRATION RATE

The baseline projections assume 200,000 immigrants in every year, a level only slightly below recent ones. Let us see now how the projections would be affected by altering that

assumption, leaving all other assumptions untouched.

Table 6 shows projections from 1996 to 2036 of population size and age distribution, the labour force, and dependency ratio indexes, under six different immigration assumptions, ranging from zero gross immigration (net immigration would be negative) up to 500,000 per year. Rather than show projections for all five dependency ratio indexes we have chosen only two to present in the table, the unweighted P - based and the weighted P/L - based. Historical and projected indexes of those two types are plotted in Figure 3. They differ most in the 1950s and 1960s, largely as a consequence of changes in labour force participation rates. The subsequent differences are much smaller, and do not affect the general conclusions to be drawn for the projection period in any major way. (The conclusions would hold as well for the other three dependency ratio definitions.) As with the dependency ratios, the population and labour force series in Table 6 are in index form.

The differences in immigration assumptions have enormous implications for the size of the population, as one would expect. At zero immigration the population grows hardly at all, and after 2016 it falls, so that by 2036 it is slightly less than what it is today. At 100,000 per year the population increases in every decade, but by the final one the rate of increase is almost negligible. At 200,000 or more there is continuous (but decelerating) growth. A rate of 500,000 per year produces a population in 2036 that is greater by four-fifths than today's population. Five hundred thousand per year implies the admission of 20 million immigrants over the 40-year projection period, a figure equal to about two-thirds of today's population. Some will have died by the end of the projection period, but many of the immigrants will have born children, and their children will have born children. It is hardly surprising that raising the rate of immigration

to 500,000 would have such a large effect on the size of the Canadian population.

The different assumptions have enormous implications for the labour force too, again as one would expect. At zero immigration per year the labour force falls after one decade into the future, and by 2036 it has shrunk by 17 percent. Even at 100,000 per year, growth lasts for only two decades, before giving way to decline. At 200,000, the decline is arrested, but the labour force remains virtually constant from 2016 on. An immigration rate of 500,000 produces a labour force in 2036 that is 66 percent greater than today's labour force (compared with a population that is 80 percent greater).

The age distribution of the population is affected by the differences in immigration levels but the basic trends remains the same.[2] The higher the rate of immigration, the smaller the proportion of people 65 and over by the end of the projection period, and the higher the proportion 20-64. Even with 500,000 immigrants per year, though, the proportion of older people rises from a little over 12 percent today to 21.3 percent by 2036, compared with 24.8 percent under the baseline assumption of 200,000 per year. Higher immigration rates slow the rise in the dependency ratio but they do not reverse it. A half-million immigrants per year over the 40-year period would produce a ratio 6 to 7 percent higher than in 1996, compared with 11 to 15 percent higher under the 200,000 assumption. In short, higher levels of immigration could reduce the "dependency burden," but the rates would have to be far higher than they are now to have a significant impact.

8. THE REGIONAL DIMENSION OF IMMIGRATION

Variations in immigration have major but differing geographic consequences -- consequences at the regional and local levels, and especially for the larger metropolitan areas to which

immigrants tend to gravitate. A detailed treatment of that important topic is beyond the boundary of this paper but we note briefly how new immigrants have distributed themselves among the provinces and territories in the past four decades, and how provincial and territorial populations might be affected by different levels of immigration in the next four.

The percentage distributions of immigrants among the provinces and territories since 1951 are shown in Table 7, by decade, and compared with the distributions of the population at the midpoints of the decades. An asterisk is attached to the immigration percentage whenever it exceeds the population percentage. As can be seen, only Ontario and British Columbia "earned" asterisks in every decade. Alberta and Manitoba did so in 1976-86, but only for that one decade. The Atlantic Region especially has received a disproportionately small share of immigrants.

We have projected the populations of the provinces and territories under two alternative assumptions about the level of immigration to Canada, and assuming that the geographic distribution of immigrants remains the same as in 1996, which was typical of recent years. (The instrument for the calculations is PMEDS, a variant of the MEDS demographic projection model, with P standing for "provincial".) The alternative immigration assumptions are 200,000 and 400,000 per year. The population projections are shown in index form in Table 8, together with the percentages of the population 65 years of age and older and unweighted population-based dependency ratios. As expected, of course, the greatest effects on population size occur in Ontario and British Columbia. At a Canadian immigration level of 200,000 per year the B.C. population grows by about 56 percent between 1996 and 2036, according to the projections; at 400,000 per year it grows by 109 percent. In other words, raising the national immigration rate to 400,000 per year would cause the B.C. population to be some 34 percent greater after four

decades than it would be if the immigration rate were to remain at 200,000 per year. In Ontario, the population would be 32 percent greater. At the other extreme, the immigration-induced differences would be of the order of only 4 to 7 percent in Newfoundland, Prince Edward Island, New Brunswick, and Saskatchewan. The projections assume constant geographic distribution patterns for immigrants, and there is, of course, no guarantee that those patterns will remain the same for the next forty years. The projections are intended merely to bring out the long-run implications of recent patterns.

The percentages of population 65 and over are affected too by the doubling of the immigration rate in Table 7, but overall the projected changes are quite modest. That is true even in B.C. and Ontario, where one might expect the greatest effects: in B.C., 25.1 percent of the population are in the old age group by 2036 if the immigration rate is 200,000 per year, 22.3 percent if it is 400,000; in Ontario the proportions are 23.7 percent and 20.8 percent. The effects on the dependency ratio indexes are correspondingly moderate. In B.C., for example, the 2036 ratio decreases from 110.2 to 106.6 when the national immigration rate is doubled.

Summing up, then, a large upward revision of the Canadian immigration rate would have much greater effects on population size in some provinces (notably B.C. and Ontario) than in others, assuming that recent geographic distribution patterns were to continue. However, the effects on the rate of population aging and dependency ratios would be relatively minor in every part of the country.

9. IMMIGRATION AS A FUTURE CONTROL INSTRUMENT

We have investigated the future effects on labour force growth of different levels of immigration. In the baseline projection, which assumes 200,000 immigrants per year, the rate of

growth was seen to be on a long-run declining path, with virtually no growth at all by two decades into the next century (Table 4). Now let us see how much immigration would be needed to stop that from happening -- to keep the labour force growing at a constant rate. (For an earlier study of the use of immigration as an instrument for influencing labour force growth and the population age distribution, see Foot, 1985. The idea of using immigration to offset a "labour shortage" has been around at least since the 1970s. See, for example, the testimony of the Chairman of the Economic Council of Canada to a special parliamentary committee on immigration policy, as recorded in Raynauld, 1975; see also Denton and Spencer, 1978, on the concept of "labour shortage.")

We proceed as follows. We choose a target labour force growth rate equal to the rate in the decade 1986-96, which was 1.154 percent per annum, or 12.2 percent over the whole of the decade. Using the MEDS projection model again, and keeping all other assumptions the same as before, we adopt a search method: we repeat the projection calculations many times, under alternative immigration assumptions, until we find the one that yields the target growth rate in each of the next four decades. That is to say, we search for the annual immigration level that yields the target labour force growth rate for the decade 1996 to 2006. Conditional on that level for 1996 to 2006, we then search for the new level that yields the target rate of labour force growth for the decade 2006 to 2016, and so on for the subsequent decades.

The results are presented in Table 9. As the table shows, an immigration level of 227,000 per year, or 0.72 percent of the population, would achieve the desired rate of labour force growth in the decade 1996 to 2006. That is a level quite close to the actual ones of recent years. In the following decade, though, immigration would have to be increased to 414,000 per year, or 1.16

percent of the population, and in the two decades after that it would have to be increased again -- to 568,000 (1.37 percent of the population) in 2016-26 and 591,000 (1.23 percent of the population) in 2026-36.

Annual immigration of 227,000 sustained for ten years (as required for the first decade of the projection) is only a little higher than the recorded average of 211 thousand over the past ten years. However, figures in the 400 to 600 thousand range are far higher than any 10-year average in Canadian history. Even in the period 1904-13, when the West was newly opened for settlement, the official immigration figures averaged only 247,000 per year. (The effective level of that period has in fact been estimated to be substantially less than the official numbers indicate, inasmuch as many immigrants who landed in Canada were destined for the United States; see Keyfitz, 1950 and 1961, McDougall, 1961, Camu, Weeks, and Sametz, 1964, Buckley, 1965, Denton, 1970, on the treatment of that problem.) In terms of raw numbers, a sustained level of 227,000 would certainly be high by historical standards, although as a percentage of the population it would be dominated by the average 1904-13 level. (Annual immigration averaged 3.7 percent of the population in that period.) The levels required to meet the growth target in the second, third, and fourth decades would set new records for Canada in terms of numbers of immigrants, although again they would fall well short of the 1904-13 average as a percentage of the population.

The Canadian dependency ratio is projected to fall slightly, and then start to rise after 5 or 10 years into the next century, under the assumptions of the baseline projection. Could the annual rate of immigration be set high enough to prevent the increase? The answer is yes, but it would have to be set extremely high. We searched for the level that would hold the ratio constant after

2016 but stopped at one million a year. Whatever definition of the dependency ratio is used, the annual immigration rate would have to be far higher than a million a year to keep the ratio from increasing, in the long run.

Immigration seems not to be an instrument of much use for controlling the dependency ratio, then, or for offsetting the process of population aging: huge increases in immigration would be required to achieve small gains. Is it useful for controlling the rate of labour force growth? Perhaps, in the nearer-term, say a decade or so, if other social and economic consequences are considered advantageous, or at least such as not to disqualify the use of the immigration instrument. In the longer-term, though, the required rates seem so high as to suggest that its value as a control instrument may be quite limited. Moreover, we are looking ahead "only" four decades into the next century. What about after that? Barring a major increase in fertility, and the associated increase in the population growth rate, the problem (if it is that) of slow labour force growth from domestic sources will still be with us. Should we be prepared to jack up the immigration rate even further then? Forty years is an eternity on the usual time scale of the economic forecaster. From a demographic point of view, though, it is only half a lifetime; a child born today will be barely middle-aged by the end of our projection period. Is it feasible and desirable to use large-scale transfers of population from other parts of the world indefinitely as an instrument to offset fertility rates that are below the replacement level? An interesting issue of public policy for the decades ahead.[3]

10. CONCLUSION

Immigration has been an important but highly variable element in the growth of the Canadian population and labour force throughout the postwar period, and much longer. In net

terms it has accounted for almost half of population growth since 1986, and about seven-tenths of labour force growth since 1991. Thus, in recent years, it has provided a major offset to the effects of fertility rates that have consistently been below the natural replacement level for the past quarter-century.

As an instrument of postwar public policy, annual immigration totals have been set largely in response to the changing state of the labour market. That is reflected in the volatility of the immigration time series. An investigation of the possibilities for using immigration in the future to stabilize the rate of growth of the labour force suggests that that could be accomplished over the next decade by keeping the annual totals somewhat above 200 thousand, in other words at roughly the levels that have obtained in recent years. For decades beyond the next one, levels in the range 400 to 600 thousand would be required. If numbers of people is the measure, those would be very high immigration rates, by historical standards. Of course, the population is larger today than in earlier times, and still growing. As percentages of the population, therefore, such immigration rates would contrast less sharply with historical experience. Sustained for long periods, though, they would still be well above anything we have seen since the early years of the century.

Immigration at substantially higher levels than today would have major effects on the size of the Canadian population and the labour force. If recent locational patterns were to continue, the effects would be quite different in different parts of the country -- greatest in British Columbia and Ontario, smallest in the Atlantic Region and Saskatchewan. In no part of the country, though, would there be a large effect on the proportionate age distribution of the population, or on the "dependency burden" represented by the age distribution. If fertility rates remain low, the

distribution will continue to shift toward the older ages. Over the next forty years the proportion of the Canadian population 65 and over is projected to rise from about 12 percent to about 25 percent, assuming immigration of 200 thousand per year. Increasing immigration to 400 thousand per year would still leave the proportion at 22 percent. Immigration is clearly not an effective tool for offsetting the process of population aging.

The "dependency ratio" can be defined in various ways. We project an increase of 11 to 16 percent in the ratio between now and the year 2041, depending on which definition is used. The ratio is affected by changes in the assumed rate of immigration, but never enough to prevent it from increasing; it is projected that the ratio will fall slightly, and then start to rise after five or ten years into the next century. To stop it from rising would require immigration far in excess of a million per year.

Our projections produce dependency ratios that are higher, in the long run, than those of today. Even so, the projected higher ratios are well below the levels experienced in Canada in the 1960s, when the baby boom had just started to wind down and the under-20 age group accounted for more than two-fifths of the population. Shifts in resource use will be required to accommodate a population in which a quarter of the total is 65 or over, but strictly in terms of the overall "dependency burden" the baby boom era appears to have been much more challenging than what lies ahead. On the other hand, productivity growth in the Canadian economy was relatively rapid during that earlier period, compared with recent experience, and that helped to increase the size of the national income at a faster pace, and to make less "painful" the required reallocation of resources. Faster productivity growth in the next few decades would help in the adjustment to an older population.[4] Elsewhere we have calculated the future annual increases in

labour productivity that would be required if the gross domestic product per capita were to grow at the rates of the 1950s and 1960s, and found the required increases to be much greater than the actual ones of the past twenty years (Denton and Spencer, 1998). Whether there will be a return to more rapid productivity growth in the coming decades is an important but unanswerable question.

APPENDIX A: THE IMMIGRATION/UNEMPLOYMENT MODEL

Equation (1) was estimated by maximum likelihood. An AR(2) error correction was necessary to whiten the residuals; the grid search procedure in SHAZAM (1997) was used. (Alternative estimation by SHAZAM's Prais-Winsten variant of the Cochrane-Orcutt procedure for handling AR(2) errors left the equation almost unaffected.) The data were the 35 annual observations for the period 1962 to 1996. The estimated equation is as follows:

$$\text{(A1)}\quad I_t = \underset{(3.2)}{46.080} - \underset{(4.2)}{12.622}\,(u-\bar{u})_{t-1} + \underset{(2.6)}{0.00791}\,S_{t-1} + \underset{(5.7)}{0.575}\,I_{t-1}$$

I is immigration in thousands; u is the percentage rate of unemployment; $\bar{u}$ (the "politically acceptable" unemployment rate) is the mean of u over the preceding 10 years; S is the cumulative sum of immigration from 1951 to the current year. (The year 1951 is an arbitrary choice. Any other pre-1962 year would serve just as well as a starting point; only the intercept in the equation would be affected.) Figures in brackets are (asymptotic) t-ratios (signs ignored). The square of the coefficient of correlation between observed and predicted values of I is 0.885.

APPENDIX B: DEPENDENCY RATIOS

Let $d = D/A$ be the dependency ratio. Adding the subscript t for time, general formulas for D and A that encompass a number of special cases are as follows:

(B1) $$D_t = \theta \sum_i \left[\alpha_i + (1 - \alpha_i) \left(\frac{\sum_a w_{ia} P_{at}}{\sum_a w_{ia} P_{a0}} \right) \right] C_{i0}$$

(B2) $$A_t = \sum_a (1 - u_{at}) \pi_{at} P_{at}$$

P is population and C is consumption (resource use); a denotes age and i denotes consumption category (whether privately or publicly funded -- food, clothing, health care, education, etc.); t=0 is a selected base period (the year 1991 in our calculations). For each consumption category i there is a (possibly nonzero) fraction α_i that is insensitive to population change and a fraction $1 - \alpha_i$ that is sensitive ($0 \le \alpha_i \le 1$; for defence expenditure α_i might be taken to be 1, for example; for publicly funded health care it might be taken to be the base period fraction of expenditure representing fixed administrative costs). The weight w_{ia} indicates the per capita population-sensitive consumption of category i at age a. (Only relative age-specific values need be specified within each category; multiplying w_{ia} by a scalar, for all a within category i, would have no effect in equation (B1).) θ is a scaling factor. Setting $\theta = P_0/C_0$ converts the right side of (B1) from "consumption units" to (weighted) "population units," and rearranging terms allows us to rewrite (B1) as

(B3) $$D_t = P_t \sum_i \left[\alpha_i / g_t + (1 - \alpha_i) \left(\frac{\sum_a w_{ia} p_{at}}{\sum_a w_{ia} p_{a0}} \right) \right] s_{i0}$$

where $s_{i0} = C_{i0}/C_0$, $g_t = P_t/P_0$ and $p_{at} = P_{at}/P_t$. D_t, the "aggregate dependency burden" at time t, is now seen to be the current population multiplied by a weighted sum of the base period expenditure shares (P^*, as defined in the text), where the weights vary with population size, age distribution, and rate of growth. In the absence of any change in size or age distribution, the "aggregate dependency burden" is equal simply to the total population. (The right side of (B3) reduces to P_t.)

Turning to the denominator of the D/A ratio, as given in equation (B2), u_{at} and π_{at} can be interpreted as the age-a unemployment and labour force participation rates, respectively, so that A_t is equal to total employment. In that case, the dependency ratio is $d = P^*/E$ -- the ratio of weighted population to total employment. If u_{at} is set to zero for all a, so that unemployment is ignored, we have $d = P^*/L$, where L is the total labour force. Setting $w_{ia} = w_i$ (no age differences), and $\alpha_i = 0$ for all i, reduces D_t to P_t, and the dependency ratio to d = P/E or P/L, depending on how the denominator is treated. If, in addition, $u_{at} = 0$ for all a, $\alpha_i = 0$ for all i, $\pi_{at} = 1$ for ages 20-64, and $\pi_{at} = 0$ for ages under 20 and 65 and over, then D_t reduces to the population of working age, and the definition of d is now $d = P/P_w$, a definition based entirely on the population age distribution ($d = P/P_w$ can equally well be written as $d = 1/(P_w/P)$, the

reciprocal of the proportion of the population 20-64). Other parameter specifications produce other definitions of the dependency ratio. The population of working age can be redefined as 15-64, as in Shryock and Siegel (1975), or 18-64, as in Ahlburg and Vaupel (1993). D can be defined as the population under 20 plus the population 65 and over, rather than the total population. (The age summations in (B3) would then be over those two groups only; the groups could be weighted or unweighted.)

The expenditure shares s_i in our calculations based on equation (B3) are derived, for the base year 1991, from data in Table 1 of Ruggeri and Hermanutz (1996). (The data in that table were compiled within the framework of the National Income and Expenditure Accounts.) We have used 18 categories of direct expenditure on goods and services (expenditures made directly by households) and 8 categories of indirect expenditure, in the form of government-provided goods and services (consolidated across levels of government). Note that transfer payments are not included; the concept is consumption or resource use in the base year, and income transfers such as OAS and CPP/QPP are not relevant. Note too that indirect taxes were removed by Ruggeri and Hermanutz from the household expenditure categories to avoid double counting with the government expenditures financed by those taxes. See the Ruggeri and Hermanutz article for additional detail.

The per capita age-specific weights w_{ia} were set by us, expenditure category by expenditure category, for each of the three broad age groups, on the basis of various information sources, and in a number of cases simply by making judgements about how usage was likely to vary with age, and the extent to which it was likely to be population-sensitive. (Where judgements were made, the three of us wrote down our "best guesses" independently in the first instance, and then recon-

ciled them to obtain final values.) Some of the sources of information include Blisard and Blaylock (1993), which provides food consumption estimates by age, Statistics Canada (1996), which gives expenditures by education level and enrollment by age, Health Canada (1996), which gives expenditures by age on public and private health care, and earlier studies of our own relating to a range of government expenditure categories (Denton and Spencer, 1980, 1985, 1997).

FOOTNOTES

1. The era of rapidly rising female participation rates appears to be over; the gap between male and female rates has been narrowed greatly in all age groups, and virtually eliminated in the youngest ones (Denton and Spencer, 1998). There have been some declines in male rates, most notably recently in the 55-64 age range. Our assumptions about future rates are arbitrary, but given the time series patterns of the rates in the various age-sex groups in recent years, any alternative assumptions that we might make would differ only slightly from the ones we have chosen, and could have only a very small effect on the projections.

2. Changes in the age distribution of immigrants could affect the growth of the labour force. However, very large shifts aside, it is known from previous work that the effects would be small, and we do not investigate them here. In thinking about possible effects the thing to focus on is not so much the difference between the immigrant and domestic population age distributions but the difference between the immigrant age distribution and the age distribution of new entrants to the labour force from within the population, the latter being predominantly people in their late teens or early twenties. The two distributions are obviously much different, and will remain much different in the face of even substantial changes in the immigrant distribution.

3. Some form of national fertility policy is at least a theoretical possibility -- a government income transfer program sufficient to encourage couples to have bigger families, say. To be effective the transfers would have to be very large. From the perspective of the public budget conscious 1990s it is difficult to imagine support for such a program across the country. However, circumstances and opinion can change over a period of several

decades, so perhaps the probability is not actually zero if we look far enough into the future.

4. There are various ways in which a society could accommodate an increased percentage of older people. The most obvious ones are the use of the tax/transfer system and government budgetary reallocations (smaller proportions for education, larger proportions for health care and public pensions). Others include changes in saving patterns (perhaps enforced, perhaps stimulated by government incentive measures), delayed retirement (consistent with higher life expectancies), greater reliance on household production, intergenerational transfers within families (as distinguished from societal intergenerational transfers through the tax/transfer system), and changes in informal patterns of family support and living arrangements. All of the foregoing would be facilitated or made unnecessary by higher levels of national productivity.

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FIGURE 1: ANNUAL GROSS IMMIGRATION, 1951 TO 1996

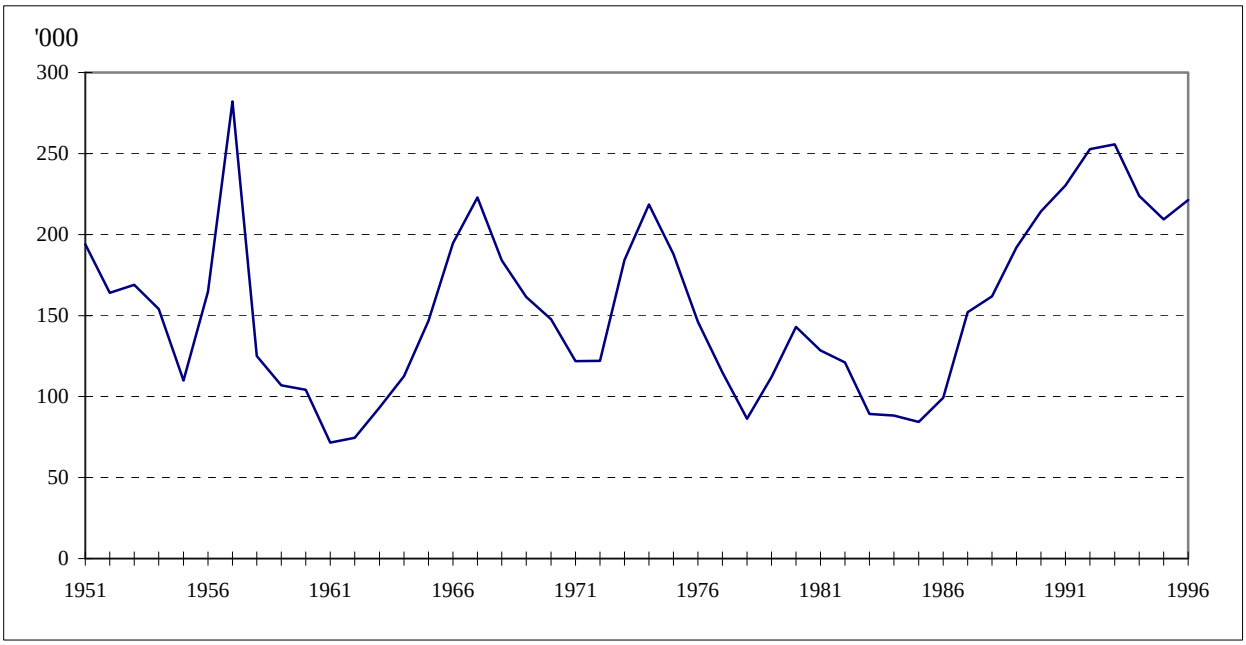

FIGURE 2: ANNUAL GROSS IMMIGRATION AS PERCENT OF POPULATION, 1951 TO 1996

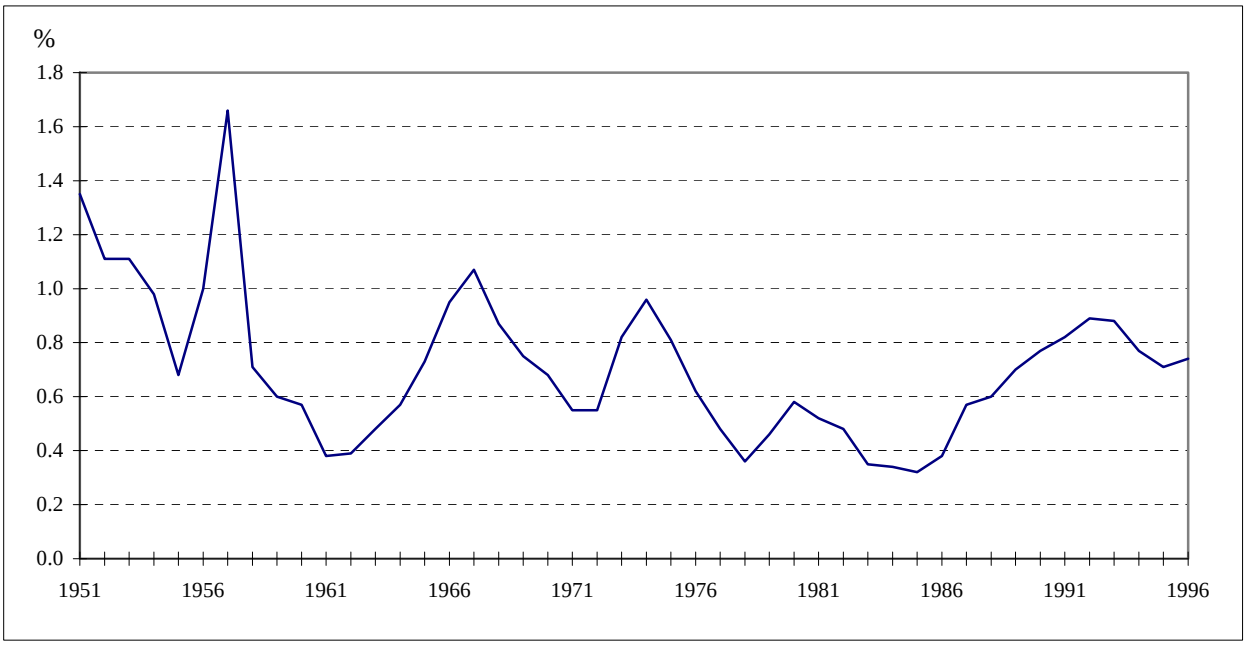

FIGURE 3: DEPENDENCY RATIOS: HISTORICAL AND PROJECTED, 1951 TO 2041 (INDEXES: 1996=100)

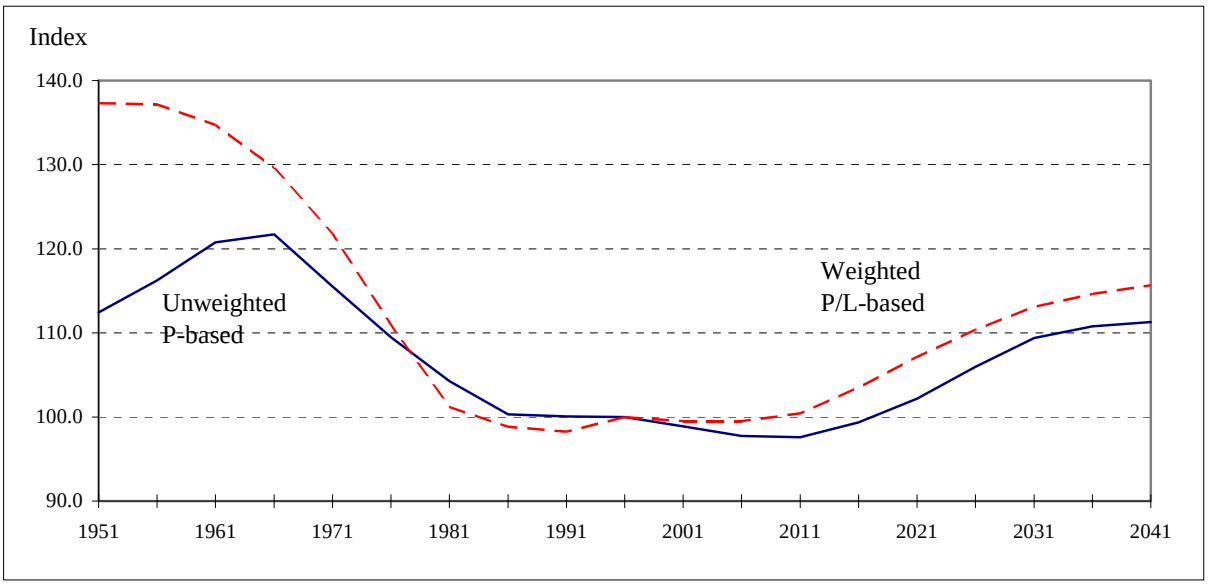

TABLE 1: POPULATION GROWTH AND ITS COMPONENTS: 5-YEAR INTERVALS, 1951-56 TO 1991-96

	Initial population ('000)	Total increase ('000)	Total increase (%)	Natural increase ('000)	Gross Immigration ('000)	Net Immigration ('000)	% share of total increase: Natural increase	% share of total increase: Net immigration
1951-56	14,333	2,115	14.8	1,478	781	637	69.9	30.1
1956-61	16,448	2,191	13.3	1,676	750	516	76.5	23.5
1961-66	18,639	1,813	9.7	1,510	548	303	83.3	16.7
1966-71	20,452	1,575	7.7	1,087	884	488	69.0	31.0
1971-76	22,026	1,491	6.8	931	849	560	62.4	37.6
1976-81	23,518	1,383	5.9	977	587	405	70.7	29.3
1981-86	24,900	1,304	5.2	987	497	317	75.7	24.3
1986-91	26,204	1,916	7.3	987	883	929	51.5	48.5
1991-96	28,120	1,721	6.1	915	1,166	806	53.2	46.8

Note: The population figures in this table and subsequent ones relate to July 1. For the period 1971-91, they are Statistics Canada's revised estimates, which incorporate definitional changes that were introduced at the time of the 1991 census. For 1951-66, they are census figures, adjusted by the authors to make them consistent with the later series. The 1996 population figure used in the calculations is the census figure, adjusted by the authors for consistency with the earlier years.

TABLE 2: COMPARISON OF MEAN AGE AND SEX DISTRIBUTIONS OF IMMIGRATION WITH CORRESPONDING DISTRIBUTIONS OF THE POPULATION

	% distribution			
	Immigrants 1976-86	Population 1981	Immigrants 1986-96	Population 1991
Age group				
Under 20	32.8	31.8	29.8	27.5
20-44	47.7	39.7	54.2	41.7
45-64	14.2	18.9	12.1	19.4
65+	5.3	9.6	3.9	11.4
Men	48.3	49.8	49.0	49.6
Women	51.7	50.2	51.0	50.4

Note: Population distributions are based on census data for 1981 and 1991 (the midpoints of the immigration decades).

TABLE 3: ESTIMATED CONTRIBUTION OF NET IMMIGRATION TO LABOUR FORCE GROWTH: 5-YEAR INTERVALS, 1951-56 TO 1991-96

	Initial labour force ('000)	Total increase ('000)	Total increase (%)	Share due to net immigration ('000)	Share due to net immigration (%)
1951-56	5,563	639	11.5	339	53.0
1956-61	6,202	781	12.6	271	34.8
1961-66	6,983	877	12.6	152	17.4
1966-71	7,860	1,170	14.9	255	21.8
1971-76	9,030	1,614	17.9	264	16.3
1976-81	10,644	1,807	17.0	173	9.6
1981-86	12,451	1,055	8.5	142	13.4
1986-91	13,506	1,034	7.7	472	45.6
1991-96	14,540	608	4.2	431	71.0

Note: Labour force figures in this table and subsequent ones are based on Labour Force Survey estimates, adjusted by the authors to include the armed forces and residents of the Yukon and Northwest Territories. A further adjustment was made to bring the 1996 figure into line with the 1996 census of population. The immigration component is based on the number of immigrants who reported that they were "destined to the labour force." To calculate the net immigration component, the labour force participation rate was assumed to be the same for all migrants as for immigrants.

TABLE 4: POPULATION, AGE DISTRIBUTION, AND LABOUR FORCE: HISTORICAL AND PROJECTED, 1951 TO 2041

	Population						Labour force		
	Total	Increase, previous 5 years		Age distribution (% of total)			Total	Increase, previous 5 years	
	('000)	('000)	(%)	Under 20	20-64	65+	('000)	('000)	(%)
					Historical				
1951	14,333	--	--	37.9	54.4	7.8	5,563	--	--
1956	16,448	2,115	14.8	39.7	52.5	7.7	6,202	639	11.5
1961	18,639	2,191	13.3	41.8	50.6	7.6	6,983	781	12.6
1966	20,452	1,813	9.7	42.1	50.2	7.7	7,860	877	12.6
1971	22,026	1,575	7.7	39.1	52.9	8.0	9,030	1,170	14.9
1976	23,518	1,491	6.8	35.6	55.8	8.6	10,644	1,614	17.9
1981	24,900	1,383	5.9	31.8	58.6	9.6	12,451	1,807	17.0
1986	26,204	1,304	5.2	28.6	60.9	10.5	13,506	1,055	8.5
1991	28,120	1,916	7.3	27.5	61.0	11.4	14,540	1,034	7.7
1996	29,841	1,721	6.1	26.7	61.1	12.2	15,148	608	4.2
					Projected				
2001	31,462	1,621	5.4	25.5	61.8	12.7	16,054	906	6.0
2006	32,945	1,483	4.7	24.2	62.5	13.3	16,831	777	4.8
2011	34,330	1,385	4.2	22.9	62.6	14.5	17,426	595	3.5
2016	35,631	1,301	3.8	21.9	61.5	16.6	17,589	163	0.9
2021	36,820	1,189	3.3	21.3	59.8	18.9	17,589	0	0.0
2026	37,848	1,028	2.8	20.8	57.6	21.5	17,567	-22	-0.1
2031	38,674	826	2.2	20.4	55.8	23.7	17,550	-17	-0.1
2036	39,293	619	1.6	20.0	55.1	24.8	17,615	65	0.4
2041	39,728	435	1.1	19.7	54.9	25.4	17,684	69	0.4

Note: The projection assumes gross immigration of 200,000 per year. See text for other assumptions.

TABLE 5: ALTERNATIVE DEPENDENCY RATIOS: HISTORICAL AND PROJECTED, 1951 TO 2041

	Unweighted P-based (P/P_W)	Unweighted P/L-based (P/L)	Unweighted P/E-based (P/E)	Weighted P/L-based (P*/L)	Weighted P/E-based (P*/E)
Ratio, 1996	1.64	1.97	2.18	1.99	2.20
Indexes (1996=100)					
			Historical		
1951	112.4	130.8	121.1	137.3	127.1
1956	116.3	134.6	125.8	137.2	128.2
1961	120.8	135.5	131.7	134.7	130.9
1966	121.7	132.1	123.4	129.6	121.1
1971	115.5	123.8	119.2	121.8	117.2
1976	109.5	112.2	111.3	110.9	110.0
1981	104.3	101.5	99.1	101.2	98.8
1986	100.3	98.5	98.3	98.9	98.7
1991	100.1	98.2	98.9	98.2	99.0
1996	100.0	100.0	100.0	100.0	100.0
			Projected		
2001	98.9	99.5	98.7	99.5	98.7
2006	97.8	99.4	98.6	99.5	98.8
2011	97.6	100.0	99.2	100.4	99.6
2016	99.3	102.8	102.0	103.5	102.7
2021	102.2	106.3	105.4	107.1	106.3
2026	106.0	109.4	108.5	110.4	109.5
2031	109.4	111.9	111.0	113.1	112.2
2036	110.8	113.2	112.4	114.6	113.7
2041	111.3	114.0	113.2	115.6	114.8

Note: P -- total population; P_W -- population of "working age" (ages 20 to 64); P* -- consumption-weighted population; L -- labour force; E -- employment.

TABLE 6: POPULATION, LABOUR FORCE, AND DEPENDENCY RATIOS: PROJECTIONS UNDER ALTERNATIVE ASSUMPTIONS ABOUT IMMIGRATION, 1996 TO 2036

	Assumed annual rate of gross immigration ('000)					
	0	100	200	300	400	500
Population (index)						
1996	100.0	100.0	100.0	100.0	100.0	100.0
2006	103.2	106.8	110.4	114.0	117.6	121.2
2016	104.2	111.8	119.4	127.0	134.6	142.2
2026	103.2	115.0	126.8	138.6	150.5	162.3
2036	99.3	115.5	131.7	147.8	164.0	180.2
% under 20						
1996	26.7	26.7	26.7	26.7	26.7	26.7
2006	23.8	24.0	24.2	24.3	24.4	24.6
2016	21.0	21.4	21.9	22.2	22.5	22.8
2026	19.7	20.3	20.8	21.3	21.6	22.0
2036	18.7	19.5	20.0	20.5	20.8	21.1
% 20-64						
1996	61.1	61.1	61.1	61.1	61.1	61.1
2006	62.3	62.4	62.5	62.6	62.7	62.8
2016	60.9	61.2	61.5	61.8	62.0	62.2
2026	55.7	56.8	57.6	58.3	58.9	59.4
2036	52.2	53.9	55.1	56.1	56.9	57.6
% 65+						
1996	12.2	12.2	12.2	12.2	12.2	12.2
2006	13.9	13.6	13.3	13.1	12.8	12.6
2016	18.1	17.3	16.6	16.0	15.5	15.0
2026	24.6	22.9	21.5	20.4	19.4	18.6
2036	29.1	26.7	24.8	23.4	22.2	21.3
Labour force (index)						
1996	100.0	100.0	100.0	100.0	100.0	100.0
2006	103.1	107.1	111.1	115.1	119.1	123.1
2016	99.4	107.8	116.1	124.5	132.8	141.2
2026	90.5	103.2	116.0	128.7	141.4	154.2
2036	83.0	99.6	116.3	133.0	149.6	166.3
Unweighted P-based dependency ratio (index)						
1996	100.0	100.0	100.0	100.0	100.0	100.0
2006	98.1	97.9	97.8	97.6	97.4	97.3
2016	100.3	99.7	99.3	98.9	98.5	98.2
2026	109.7	107.6	106.0	104.8	103.6	102.9
2036	117.0	113.5	110.8	108.9	107.3	106.1
Weighted P/L-based dependency ratio (index)						
1996	100.0	100.0	100.0	100.0	100.0	100.0
2006	100.9	100.2	99.5	98.9	98.3	97.8
2016	107.0	105.1	103.5	102.9	100.9	99.8
2026	117.7	113.6	110.4	107.9	105.8	104.1
2036	124.8	119.0	114.6	111.6	109.0	107.2

TABLE 7: COMPARISON OF MEAN DISTRIBUTIONS OF CANADIAN IMMIGRATION, BY PROVINCE OR TERRITORY OF DESTINATION, WITH CORRESPONDING POPULATION DISTRIBUTIONS

	% distribution							
	Immigration 1956-66	Population 1961	Immigration 1966-76	Population 1971	Immigration 1976-86	Population 1981	Immigration 1986-96	Population 1991
Newfoundland	0.32	2.51	0.52	2.42	0.40	2.32	0.28	2.06
P.E.I.	0.07	0.57	0.12	0.51	0.15	0.50	0.08	0.47
Nova Scotia	1.10	4.04	1.25	3.63	1.16	3.44	1.06	3.27
New Brunswick	0.71	3.28	0.85	2.93	0.80	2.84	0.35	2.66
Quebec	21.84	28.83	16.96	27.95	17.21	26.38	17.17	25.18
Ontario	52.94 *	34.20	53.44 *	35.72	46.06 *	35.49	53.58 *	37.24
Manitoba	3.43	5.05	3.90	4.54	4.38 *	4.17	2.40	3.96
Saskatchewan	1.69	5.07	1.41	4.24	2.09	3.93	1.08	3.58
Alberta	6.30	7.31	7.07	7.59	12.37 *	9.25	7.71	9.25
British Columbia	11.48 *	8.93	14.34 *	10.22	15.23 *	11.39	16.20 *	12.01
Yukon	0.04	0.08	0.05	0.09	0.06	0.10	0.04	0.10
N.W.T.	0.06	0.13	0.09	0.17	0.09	0.19	0.05	0.22
Canada	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: Population distributions are based on census data for 1961, 1971, 1981, and 1991 (the midpoints of the immigration decades). An asterisk indicates a decade in which a province or territory had a percentage of immigration that exceeded its percentage of the Canadian population.

TABLE 8: IMMIGRATION AND PROVINCIAL OR TERRITORIAL POPULATIONS: ALTERNATIVE PROJECTIONS, 1996 TO 2036

	Year								
	1996	2006		2016		2026		2036	
		I=200	I=400	I=200	I=400	I=200	I=400	I=200	I=400
Population (index)									
Newfoundland	100.0	97.9	98.9	97.3	99.6	93.5	97.0	85.8	90.6
P.E.I.	100.0	107.4	108.8	111.0	114.0	112.5	117.6	111.0	117.6
Nova Scotia	100.0	104.5	108.4	108.2	116.1	109.5	121.9	107.8	124.8
New Brunswick	100.0	102.1	103.0	102.3	104.0	100.0	102.6	94.6	98.3
Quebec	100.0	105.7	109.5	110.3	118.3	113.0	125.6	113.2	130.5
Ontario	100.0	113.3	123.6	125.6	147.4	136.9	170.7	145.9	192.1
Manitoba	100.0	104.9	108.2	111.0	117.9	116.4	127.2	120.0	135.0
Saskatchewan	100.0	103.2	104.9	108.6	112.3	112.8	118.5	115.2	123.2
Alberta	100.0	110.3	115.4	119.3	130.0	126.0	142.7	129.5	152.4
British Columbia	100.0	119.7	131.9	133.9	159.4	146.3	185.7	155.9	209.3
Yukon	100.0	112.5	112.5	121.9	121.9	125.0	125.0	128.1	128.1
N.W.T.	100.0	120.3	124.6	147.8	155.1	176.8	188.4	207.2	224.6
Canada	100.0	110.4	117.6	119.4	134.6	126.8	150.5	131.6	164.0
% 65+									
Newfoundland	10.6	12.3	12.2	17.4	17.1	24.7	24.0	30.6	29.6
P.E.I.	13.0	13.7	13.6	17.4	17.1	22.2	21.6	26.1	25.3
Nova Scotia	12.8	14.0	13.6	18.0	17.2	23.8	22.2	28.0	25.8
New Brunswick	12.5	14.1	14.0	18.8	18.6	25.7	25.2	31.1	30.4
Quebec	12.1	13.9	13.6	18.1	17.2	23.8	22.0	27.1	24.8
Ontario	12.2	13.3	12.7	16.2	14.8	20.4	18.0	23.7	20.8
Manitoba	13.6	13.8	13.5	16.0	15.4	19.9	18.8	22.2	20.8
Saskatchewan	14.5	14.8	14.6	16.3	16.0	20.9	20.2	23.0	22.1
Alberta	9.8	11.5	11.2	14.9	14.3	20.9	19.4	24.2	22.3
British Columbia	12.8	13.3	12.7	16.6	15.3	21.4	19.2	25.1	22.3
Yukon	4.5	6.2	6.2	11.4	11.4	17.5	17.5	20.1	20.1
N.W.T.	3.1	4.2	4.2	6.2	6.1	9.0	8.8	11.2	11.0
Canada	12.2	13.3	12.8	16.6	15.5	21.5	19.4	24.8	22.2
Unweighted P-based dependency ratio (index)									
Newfoundland	100.0	93.5	93.5	96.0	95.7	103.9	103.2	111.7	110.3
P.E.I.	100.0	96.2	96.4	98.3	98.2	103.5	103.0	108.6	107.7
Nova Scotia	100.0	96.8	96.7	98.5	98.2	106.3	104.6	112.3	109.5
New Brunswick	100.0	96.5	96.5	99.2	99.0	107.9	107.4	116.3	115.2
Quebec	100.0	98.4	98.4	101.5	101.0	110.1	108.0	115.2	111.8
Ontario	100.0	98.6	98.1	99.7	98.7	105.1	102.7	110.3	106.2
Manitoba	100.0	97.6	97.3	98.3	97.8	103.9	102.7	107.2	105.3
Saskatchewan	100.0	95.0	94.8	94.7	94.4	101.5	100.5	103.0	101.7
Alberta	100.0	96.8	96.7	97.9	97.7	106.7	105.0	110.8	108.2
British Columbia	100.0	97.3	96.7	99.2	98.2	105.0	102.7	110.2	106.6
Yukon	100.0	95.6	95.6	98.9	98.9	107.3	107.3	109.3	109.3
N.W.T.	100.0	99.6	99.3	99.1	98.8	102.7	102.2	105.0	104.4
Canada	100.0	97.8	97.4	99.3	98.5	106.0	103.6	110.8	107.3

Note: I=200 and I=400 indicate projections that assume Canadian annual immigration of 200,000 and 400,000, respectively.

TABLE 9: IMMIGRATION REQUIRED BETWEEN 1996 AND 2036, BY DECADE, TO MAINTAIN LABOUR FORCE GROWTH AT ITS 1986-96 RATE

	Required annual immigration	
	('000)	(% of population)
1996-2006	227	0.72
2006-2016	414	1.16
2016-2026	568	1.37
2026-2036	591	1.23

Note: The 1986-96 rate of growth of the labour force was 1.154 percent per annum, or 12.2 percent over the decade. Immigration as % of population in each decade is calculated using the mean population for the decade.

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